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RELATING AEROSOL PROPERTIES TO CCN SPECTRA AND CLOUD PROPERTIES

Liu, Y., Daum, P., Miller, M., and McGraw, R.

For Presentation at the
ARM Science Team Meeting,
Albuquerque, NM
March 27-31, 2006

February 2006

Environmental Sciences Department/Atmospheric Sciences Division
Brookhaven National Laboratory
P.O. Box, Upton, NY
www.bnl.gov

ABSTRACT

The indirect aerosol effect is probably the most uncertain among known climate forcings, and much of the uncertainty arises from poor understanding and quantification of the relationship of relevant aerosol properties to cloud condensation nuclei (CCN) and cloud properties. The primary objective of this work is to derive theoretical expressions that analytically relate CCN spectra, cloud droplet number concentration and relative dispersion of the cloud droplet size distribution to the three commonly used moments of the aerosol size distribution: aerosol number concentration, aerosol mass loading and relative dispersion of the aerosol size distribution. It is shown that part of the uncertainty in evaluation of indirect aerosol effects is due to the traditional use of either aerosol number concentration or mass loading as the only aerosol variable in parameterization of droplet concentration. We will also examine the effect of commonly used aerosol size distributions (power-law, lognormal, Gamma and Weibull) on CCN spectra and cloud properties. The results will be useful for improving evaluation of indirect aerosol effects, and for understanding observed CCN spectra. The theoretical results will be compared with observations.